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PREPARATIONS FOR THE UNITED NATIONS CONFERENCE ON ENVIRONMENT AND DEVELOPMENT ON THE BASIS OF GENERAL ASSEMBLY RESOLUTION 44/228 AND TAKING INTO ACCOUNT OTHER RELEVANT GENERAL ASSEMBLY RESOLUTIONS: CROSS-SECTORAL ISSUES

PROTECTION OF THE QUALITY AND SUPPLY OF FRESHWATER RESOURCES: APPLICATION OF INTEGRATED APPROACHES TO THE DEVELOPMENT, MANAGEMENT AND USE OF WATER RESOURCES

(Section II, Chapter 10, of Agenda 21)

Text submitted by the Chairman on the basis of negotiations held on document A/CONF.151/PC/100/Add.22

INTRODUCTION

1. The present document has been prepared by the Secretary-General of the Conference in response to Preparatory Committee decision 3/22. It is based on the guidance provided by the Preparatory Committee on the structure of Agenda 21, as contained in decision 3/2.

2. Effectively integrated management of water resources is important to all socio-economic sectors relying on water. Rational allocation prevents conflict and enhances the social development of local communities as well as economic planning and productivity. Efficient demand management allows water-using sectors to make long-term savings on water costs and stimulates resource-conscious production technologies. Health conditions and environmental quality should also improve, either as a result of integrated

development planning or as a beneficial consequence of improved environmental or social conditions.

Linkages to other environmental and developmental issues

3. Water is a finite resource, essential for the sustenance of life on earth. Virtually all the environmental issues listed in General Assembly resolution 44/228 are directly or indirectly linked to freshwater issues. With increases in economic activities and the consequent potential for stress on ecosystems and natural resource stocks, the study and recognition of linkages between freshwater issues and other sectoral and cross-sectoral issues is becoming increasingly important. Socio-economic pursuit/including urbanization, industrial production and agricultural activities/has reached a stage where freshwater issues have often become the limiting factor for sustainable development. Freshwaters/rivers, reservoirs, lakes and groundwaters [, polar ice mass and glaciers]/are in contact with other ecosystems and are used in a variety of human activities, many of which would not be possible without a freshwater supply of adequate quality and quantity.

4. Poor land-use management, including deforestation, non-sustainable agriculture, mining and urbanization, could lead to a considerable increase in erosion problems and related soil loss in the river basins. The sedimentation in large reservoirs may have serious adverse effects downstream by reducing the quantity of natural nutrients available to agricultural land or to coastal waters. The loss of nutrients can lead to increased fertilizer use and decreases in coastal fishery yields. Acidification of surface and some groundwaters owing to atmospheric deposition of air pollutants can lead to depletion of freshwater living resources, contributing to the loss of biodiversity. Construction of dams for hydropower and irrigation, water channelization, over-abstraction from aquifers, use of water bodies as open sewers for the discharge of both domestic and industrial wastes can lead to the salinization of rivers, lakes, and soils, salt intrusions in coastal aquifers, and serious water pollution problems. Should climate change occur as a result of global warming, it would affect low-lying island freshwater resources and may affect the world's freshwater resources through [the melting of ice mass in the Arctic and Antarctic regions and] changes in the hydrologic cycle, resulting in changes in precipitation, with possible decreases in many areas of the Northern Hemisphere, accompanying decreases in soil moisture and annual river runoff. Even in the absence of global warming, a natural variation in precipitation may be expected, as in the past, resulting in periodic drought which can impact water availability, with consequent negative implications for economy and development. Because of these concerns, an integrated approach to freshwater management seems vital, along with, for example, an integrated approach to pollution control, the optimal use of water and a holistic approach to the conservation of ecosystems.

5. Transboundary water resources and their use are of great importance to riparian States. In this connection, cooperation among these States may be desirable in conformity with existing agreements and/or other relevant arrangements, taking into account the interests of all riparian States concerned.

6. Water-related diseases are still a major health problem, especially in the developing countries. Diseases caused by the microbiological pollution of water supplies or transmitted by water-associated vectors, and those related to inadequate sanitation and the absence of clean water, are widespread. With water use per capita expected to increase significantly in developing countries with high economic or population growth rates, the volume of waste requiring treatment is expected to present a growing problem. Likewise, the application of water-intensive production techniques and other high water-use consumption patterns are of concern in certain countries, particularly industrial ones. To ignore the interactions and linkages between freshwater issues and other sectoral issues could result in severe social, economic or human health consequences. Therefore, the provision of water supply and sanitation in developing countries is not only a vital ingredient of economic and social development but also an important element of environmental protection.

GENERAL OBJECTIVES

7. Water is a necessity for all aspects of life. The general objective is to ensure that all the population of the planet have access and continue to have access to an adequate supply of water of good quality, while maintaining the hydrological, biological and chemical functions of ecosystems, adapting human activities to the capacity limits of nature, combating water-borne diseases and preserving spiritual and cultural values.

8. Freshwater resources are an essential component of the earth's hydrosphere and an indispensable part of all terrestrial ecosystems. The freshwater environment is characterized by its hydrological regime, including floods and droughts which, in some regions, have become more extreme and dramatic in their consequences in recent years. Global climate changes could also have their impact on freshwater resources and their availability and, through sealevel rise and atmospheric pollution, threaten coastal aquifers and small island ecosystems.

9. Freshwaters are a finite resource, not only indispensable for the sustenance of life on earth but also of vital importance to all socio-economic sectors. Development is not possible without considerable exploitation of water sources in relation to other land use activities and the control of deforestation and desertification. Priority must be given to the sustenance of land/water ecosystems, with particular attention to wetlands and biodiversity, and the satisfaction of basic human needs for drinking water. health protection and food security. For any water utilization beyond this, freshwater resources have to be considered as an economic good with an opportunity cost in alternative uses.

10. The Mar del Plata Action Plan, which emerged from the United Nations Water Conference in 1977, remains generally valid as the common basis for national and international action programmes in the freshwater sector. The review of progress achieved in its implementation and resulting strategies for

the 1990s are reflected in Economic and Social Council resolution 1991/85. Agenda 21 in this sector, as presented hereunder, is based on these strategies, on the results of the Global Consultation on Safe Water and Sanitation for the 1990s, held at New Delhi in September 1990 (see General Assembly resolution 45/181) and on the recommendations that may emerge from the International Conference on Water and the Environment, held in Dublin in January 1992, and on the results of the Preparatory Committee.

11. The widespread scarcity of freshwater resources, the progressive encroachment of incompatible activities and the gradual destruction of freshwater resources and their aggravating pollution in many world regions demands truly integrated water resources planning and management. The multisectoral nature of water resources development in the context of socio-economic development must be recognized as well as the multi-interest utilization of water resources for agriculture, industry, urban development, hydropower, inland fisheries, transportation, recreation and other activities. Rational water utilization schemes for the development of surface and underground water supply sources and other potential sources have to be supported by concurrent water conservation and wastage minimization measures.

12. Integrated water resources management necessitates appropriate mechanisms at the global, regional, national and local levels for implementing, coordinating and funding the related strategies and action programmes. Management of water resources should, as far as possible, take place in a river basin context (catchment level). [The options proposed by the International Conference on Water and the Environment/Development Issues for the 21st Century, held in Dublin, January 1992, has provided an input to identifying suitable implementation mechanisms.]

13. Capacity-building is a prerequisite to integrated water resources management. Technical solutions will not achieve programme objectives on their own without suitable attention given to the human factor. The Symposium on a Strategy for Water Resources Capacity-Building, held at Delft in June 1991, recognized the importance of capacity-building for integrated and sustainable development of water resources at all levels. Capacity-building consists of four basic elements:

(a) Creating an enabling environment with appropriate policy and legal frameworks;

(b) Institutional strengthening and development, including local community participation;

(c) Human resources development, including the strengthening of managerial systems and water users interests;

(d) Awareness building and education at all levels of society, [including, inter alia, the consideration of a United Nations World Water Day].

14. [Adequate new and additional financial resources are indispensable for the effective utilization and protection of freshwater resources. Pursuant to the recognition of water as an economic good, but with priority to the satisfaction of basic needs, internal revenues have to be generated through cost-recovery schemes, water tariffs, taxes etc. for uses implying productive activities, reflecting marginal and opportunity costs. In addition, external support will be required for water resources development from multilateral or bilateral sources (external support agencies) and from the private sector.]

15. Innovative technologies, including the improvement of indigenous techniques, are much needed to fully utilize limited water resources and to safeguard them against pollution. Implementation of Agenda 21 in the water sectors must therefore be supported by broad-based research and development programmes allowing for new technological solutions to be developed and field-tested. Technology [transfer on preferential and concessional terms] and [cooperation and diffusion] on all aspects of integrated water resources management is to be built into each programme area.

16. In accordance with the general objectives, the following programme areas are proposed for the freshwater sector:

(a) Integrated water resources development and management;

(b) Water resources assessment;

(c) Protection of water resources, water quality and aquatic ecosystems;

(d) Drinking water supply and sanitation;

(e) Water and sustainable urban development;

(f) Water for sustainable food production and rural development;

(g) Impacts of climate change on water resources.

PROGRAMME AREAS

A. Integrated water resources development and management

Basis for action

17. The extent to which water resources development contributes to economic productivity and social well-being is not usually appreciated, although all social and economic activities rely heavily on the supply and quality of freshwater. As populations and economic activities grow, many countries are rapidly reaching conditions of water scarcity or face limits to economic development. Water demands are increasing rapidly, with 70-80 per cent for irrigation, less than 20 per cent for industry and a mere 6 per cent for domestic consumption. The holistic management of fresh water as a finite and

vulnerable resource, and the integration of sectoral water plans and programmes within the framework of national economic and social policy, is of paramount importance for action in the 1990s and beyond. The fragmentation of responsibilities for water resources development among sectoral agencies is proving, however, to be an even greater impediment to promoting integrated water management than had been anticipated. Effective implementation and coordination mechanisms are required.

Objectives

18. The overall objective is to satisfy the freshwater needs of all countries for their sustainable development.

19. Integrated water resources management is based on water as an integral part of the ecosystem, a natural resource, a social good and an economic good, the quantity and quality of which determines its utilization. To this end, water resources have to be protected, taking into account the functioning of aquatic ecosystems and the perenniality of the resource in order to satisfy or reconcile water needs for human activities. In developing and using water resources, priority has to be given to the satisfaction of basic needs and the safeguarding of ecosystems. Beyond these requirements, however, water users should be charged appropriately.

20. Integrated water resources management, including the integration of land and water aspects, should be carried out at the catchment basin or sub-basin level. Four principal objectives should be pursued, as follows:

(a) To promote a dynamic, interactive, iterative and multisectoral approach to water resources management, including the identification and protection of potential sources of freshwater supply, which integrates technological, socio-economic, environmental and human health considerations;

(b) To plan for the sustainable and rational utilization, protection, conservation and management of water resources based on community needs and priorities and within the framework of national economic development policy;

(c) To design, implement and evaluate projects and programmes which are both economically efficient and socially appropriate within clearly defined strategies, based on a full public participatory approach, including the participation of women, youth, indigenous people and local communities in water management policy-making and decision-making;

(d) To identify and strengthen or develop, as required, in particular in developing countries, the appropriate institutional, legal and financial mechanisms to ensure that water policy and its implementation is a catalyst for sustainable social progress and economic growth.

21. In the case of transboundary water resources, there is a need for riparian States to formulate water resource strategies, prepare water resource action programmes and consider, where appropriate, the harmonization of those strategies and action programmes.

22. [All States, according to their capacity and available resources, and through bilateral or multilateral cooperation, including through the United Nations and other relevant organizations as appropriate, could set the following targets:

By the year 2000:

(a) Have designed and initiated costed and targeted national action programmes, and have appropriate institutional structures and legal instruments in place;

(b) Have established efficient water use programmes to attain sustainable resource utilization patterns.

By the year 2025:

(c) Reach subsectoral targets of all freshwater programme areas.

It is understood that the fulfilment of the targets quantified in (a) and (b) above will depend upon new and additional financial resources that will be made available to developing countries in accordance with the relevant provisions of General Assembly resolution 44/228.]

Activities

23. All States, according to their capacity and available resources, and through bilateral or multilateral cooperation, including through the United Nations and other relevant organizations, as appropriate, could implement the following activities to improve integrated water resources management:

(a) Formulation of costed and targeted national action plans and investment programmes;

(b) Integration of measures for the protection and conservation of potential sources of freshwater supply, including the inventorying of water resources, with land-use planning, forest resource utilization, protection of mountain slopes and riverbanks and other relevant development and conservation activities;

(c) Development of interactive databases, forecasting models, and economic planning models, methods for water management and planning, including environmental impact assessment methods;

(d) Optimization of water resources allocation under physical and socio-economic constraints;

(e) Implementation of allocation decisions through demand management, pricing mechanisms and regulatory measures;

(f) Flood and drought management, including risk analysis and environmental and social impact assessment;

(g) Promotion of schemes for rational water use through public awareness raising, educational programmes, levying of water tariffs and other economic instruments;

(h) Mobilization of water resources, particularly in arid and semi-arid areas;

(i) Promotion of international scientific research cooperation on freshwater resources;

(j) Development of new and alternative sources of water supply such as seawater desalination, artificial groundwater recharge, use of marginal-quality water, wastewater reuse and water recycling;

(k) Integration of water quantity and quality management, including surface and underground water resources;

(l) Promotion of water conservation through improved water use efficiency and wastage minimization schemes for all users, including the development of water-saving devices;

(m) Support to water users groups to optimize local water resources management;

(n) Development of public participatory techniques and their implementation in decision-making, particularly the enhancement of the role of women in water resources planning and management;

(o) Development and strengthening, as appropriate, of [implementation mechanisms] [cooperation] [mechanisms for cooperation][cooperation, including mechanisms where appropriate] at all levels concerned:

(i) Generally, delegation of water resources management to the lowest appropriate level, in accordance with national legislation, including decentralization of government services to local authorities, private enterprises and communities;

(ii) At the national level, integrated water resources planning and management in the framework of the national planning process, and, where appropriate, establishment of independent regulation and monitoring of freshwater, based on national legislation and economic measures;

(iii) At the regional level, to consider, where appropriate, harmonization of national strategies and action programmes;

(iv) At the global level, improved delineation of responsibilities, division of labour and coordination of international organizations and programmes, including facilitating discussions and sharing experiences in areas related to water resources management;

(p) The dissemination of information, including operational guidelines, and the promotion of education for water users.

Means of implementation

Financing and cost evaluation

24. [During the period 1993 to 2000, an annual amount of about US$ 100 million of international financing is required to support national development in this programme area. The strengthening of international institutions in support of the planning and initiation phases at the country level requires the allocation of about US$ 10 million per year. The transboundary and global freshwater issues require financial support in the order of US$ 5 million annually for the executing of national, regional and global authorities and organizations. The total annual financing requirements in this programme area amount to US$ 115 million.]

Scientific and technological means

25. The development of interactive databases, forecasting methods and economic planning models appropriate to the task of managing water resources in an efficient and sustainable manner will require the application of new techniques such as geographic information systems and expert systems to gather, assimilate, analyse and display multisectoral information and also to optimize decision-making. In addition, the development of new and alternative sources of water supply and low-cost water technologies will require innovative applied research. This will involve the transfer, adaption and diffusion of new techniques and technology to developing countries, as well as the development of endogenous capacity, to be able to deal with the added dimension of integrating engineering, economic, environmental and social aspects of water resources management and the prediction of the effects of human impacts.

26. Pursuant to the recognition of water as an economic and social good, the various available options for charging water users have to be further evaluated and field-tested, including domestic, urban, industrial and agricultural water user groups. Further development is required on economic instruments that take into account opportunity costs and environmental externalities. Field studies on the willingness to pay should be conducted in rural and urban situations.

26 (bis). Water resources development and management should be planned in an integrated manner, taking into account long-term planning needs as well as shorter horizons, i.e., it should incorporate environmental, economic and social considerations based on the principle of sustainability; it should

include the requirements of all users as well as those relating to the prevention and mitigation of water-related hazards; and it should be an integral part of the socio-economic development planning process. A prerequisite for the sustainable management of water as a scarce vulnerable resource is that its full costs should be acknowledged in all planning and development. Planning considerations should reflect benefits investment, environmental protection and operation costs, as well as the opportunity costs reflecting the most valuable alternative use of water. Actual charging need not necessarily burden all beneficiaries with these considerations. Charging mechanisms should, however, reflect as far as possible both the true cost of water when used as an economic good and the ability of the communities to pay.

26 (ter). The role of water as a social, economic and life-sustaining good should be reflected in demand management mechanisms and implemented through water conservation and re-use, resource assessment, and financial instruments.

26 (quart). The setting of priorities afresh for private and public investment strategies should take place taking into account (a) maximum utilization of existing projects, through maintenance, rehabilitation and optimal operation; (b) new or alternative clean technologies; and (c) environmentally and socially benign hydro-power.

Human resources development

27. The delegation of water resources management to the lowest appropriate level necessitates the education and training of water management staff at all levels, and ensuring that women participate equally in these education and training programmes. Particular emphasis has to be placed on the introduction of public participatory techniques, including enhancement of the role of women, youth, indigenous people and local communities. Skills related to various water management functions have to be developed by municipal government and water authorities and also in the private sector, local/national non-governmental organizations, cooperatives, corporations and other water user groups. Education of the public in the importance of water and its proper management is also needed.

27 (bis). To implement these principles, communities need to have adequate capacities. Those who establish the framework for water development and management at any level, whether international, national or local, need to ensure that the means exist to build those capacities. The means will vary from case to case. They usually include:

(a) Awareness-creation programmes, including mobilizing commitment and support at all levels and initiating global and local action to promote such programmes;

(b) The training of water managers at all levels so that they have an appropriate understanding of all the elements necessary for their decisions;

(c) The strengthening of training capacities in developing countries;

(d) Appropriate training of the necessary professionals, including extension workers;

(e) Improvement of career structures;

(f) Sharing of appropriate knowledge and technology, both for the collection of data and for the implementation of planned development; this should include non-polluting technologies and the knowledge needed to extract the best performance from the existing investment system.

Capacity-building

28. Institutional capacity for implementing integrated water management should be reviewed and developed when there is a clear demand. Existing administrative structures will often be quite capable of achieving local water resources management, but the need may arise for new institutions based upon, e.g., river catchment areas, district development councils or local community committees. Although water is managed at various levels in the socio-political system, demand-driven management requires the development of water-related institutions at appropriate levels, taking into account the need for integration with land use management.

29. In creating the enabling environment for lowest appropriate-level management, the role of Government includes mobilization of financial and human resources, legislation, standard-setting and other regulatory functions, monitoring and assessment of the use of water and land resources, and creating opportunities for public participation. International agencies and donors have an important role to play to support developing countries in creating the required enabling environment for integrated water resources management. This should include, as appropriate, donor support to local levels in developing countries, including community-based institutions, non-governmental organizations and women's groups.

B. Water resources assessment

Basis for action

30. Water resources assessment, including the identification of potential sources of freshwater supply, is the continuing determination of sources, extent, dependability and quality of water resources and of the human activities which affect these resources. It is the practical basis for their sustainable management and a prerequisite for evaluation of the possibilities for this development. There is, however, growing concern that at a time when more precise and reliable information is needed about water resources, hydrological services and related bodies are less able to provide this information, especially information on groundwater and water quality. Major impediments are the lack of financial resources for water resources assessment, the fragmented nature of hydrological services and the insufficient numbers of qualified staff. At the same time, the advancing

technology for data capture and management is increasingly difficult to access for developing countries. Establishment of national databases is, however, vital to water resources assessment and for mitigating the effects of floods, droughts, desertification and pollution.

Objectives

31. Based upon the Mar del Plata Action Plan, this programme area is extended into the 1990s and beyond with the overall objective of ensuring the assessment and forecasting of the quantity and quality of water resources, in order to estimate the total quantity of water resources available and their future supply potential, to reflect their current quality status, to predict possible conflicts between supply and demand and to provide a scientific database for rational water resource utilization.

32. Five specific objectives are set, accordingly, as follows:

(a) To make available to all countries water resource assessment technology that is appropriate to their needs, irrespective of their level of development, including methods for the impact assessment of climate change on freshwaters;

(b) To have all countries, according to their financial means, allocate to water resource assessment financial resources in line with the economic and social needs for water resources data;

(c) To ensure that the assessment information is fully utilized in the development of water management policies;

(d) To have all countries establish the institutional arrangements needed to ensure the efficient collection, processing, storage, retrieval and dissemination to users of information about the quality and quantity of available water resources at the level of catchments and groundwater aquifers in an integrated manner;

(e) To have sufficient numbers of appropriately qualified and capable staff recruited and retained by water resource assessment agencies, and provided with the training and retraining they need to carry out their responsibilities successfully.

33. [All States, according to their capacity and available resources, and through bilateral or multilateral cooperation, including through the United Nations and other relevant organizations, as appropriate, could set the following targets:

(a) By the year 2000, have studied in detail the feasibility of installing water resources assessment services;

(b) As a long-term target, have fully operational services available based upon high-density hydrometric networks.]

Activities

34. All States, according to their capacity and available resources, and through bilateral or multilateral cooperation, including through the United Nations and other relevant organizations, as appropriate, could undertake the following activities:

(a) Institutional framework

(i) Establish appropriate policy frameworks and national priorities;

(ii) Establish and strengthen the institutional capabilities of countries, including legislative and regulatory arrangements, that are required to ensure the adequate assessment of their water resources and the provision of flood and drought forecasting services;

(iii) Establish and maintain effective cooperation at the national level between the various agencies responsible for the collection, storage and analysis of hydrological data;

(iv) Cooperate in the assessment of transboundary water resources, subject to the prior agreement of each riparian State concerned;

(b) Data systems

(i) Review existing data collection networks and assess their adequacy, including those that provide real time data for flood and drought forecasting;

(ii) Improve networks to meet accepted guidelines for the provision of data on water quantity and quality for surface and groundwater, as well as relevant land use data;

(iii) Apply standards and other means to ensure data compatibility;

(iv) Upgrade facilities and procedures used to store, process and analyse hydrological data and make such data and the forecasts derived from them available to potential users;

(v) Establish databases on the availability of all types of hydrological data at the national level;

(vi) Implement "data rescue" operations, e.g., establishment of national archives of water resources;

(vii) Implement appropriate well-tried techniques for the processing of hydrological data;

(viii) Derive area-related estimates from point hydrological data;

(ix) Assimilate remotely sensed data and the use, where appropriate, of geographical information systems;

(c) Data dissemination

(i) Identify the need for water resources data for various planning purposes;

(ii) Analyse and present data and information on water resources in the forms required for planning and management of countries' socio-economic development, for use in environmental protection strategies and in the design and operation of specific water-related projects;

(iii) Provide forecasts and warnings of flood and drought to the general public and civil defense;

(d) Research and development

(i) Establish or strengthen research and development programmes at the national, subregional, regional and international levels in support of water resources assessment activities;

(ii) Monitor research and development activities to ensure that they make full use of local expertise and other local resources and that they are appropriate for the needs of the country or countries concerned.

Means of implementation

Financing and cost evaluation

35. [In order to attain the programme area targets as stated above by the year 2000, total average annual funding in the order of US$ 350 million is required, including contributions from external sources of US$ 140 million annually. The strengthening of international institutions for the development and exchange of information and technology requires about US$ 5 million per year. The total international financing needs for the years 1993 to 2000 for this programme area amount to US$ 145 million annually.]

Scientific and technological means

36. Important research needs include (a) development of global hydrologic models in support of analysis of climate change impact and of macroscale water resources assessment; (b) closing the gap between terrestrial hydrology and ecology at different scales, including the critical water-related processes behind loss of vegetation, land degradation and its restoration; and (c) study of the key processes in water quality genesis, closing the gap between hydrological flows and biogeochemical processes. The research models should build upon hydrological balance studies and also include the consumptive use of water. This approach should also, when appropriate, be applied at the catchment level.

37. Water resources assessment necessitates the strengthening of existing systems for technology transfer, adaptation and diffusion, and the development of new technology for use under field conditions, as well as the development of endogenous capacity. Prior to the above activities, it is necessary to prepare catalogues of the water resources information held by government services, private sector, educational institutes, consultants, local water use organizations and others.

Human resource development

38. Water resources assessment requires the establishment and maintenance of a body of well-trained and motivated staff sufficient to undertake the above activities. Education and training programmes should be established or strengthened at the local, national, subregional or regional levels designed to ensure an adequate supply of these trained personnel. In addition, the provision of attractive terms of employment and career paths for professional and technical staff should be encouraged. Human resource needs should be monitored periodically, including all levels of employment. Plans have to be established to meet those needs through education and training opportunities, and international programmes of courses and conferences.

38 (bis). Because well-trained people are particularly important to water resources assessment and hydrological forecasting, personnel matters should receive special attention in this area. The aim should be to attract and retain personnel to work on water resources assessment who are sufficient in number and adequate in their level of education to ensure the effective implementation of the activities that are planned. Education may be called for at both the national and the international level, while adequate terms of employment are a national responsibility.

38 (ter). Recommended actions include:

(a) Identifying education and training needs geared to the specific requirements of countries;

(b) Establishing and strengthening education and training programmes on water-related topics, within an environmental and developmental context, for all categories of staff involved in water resources assessment activities, using advanced educational technology, where appropriate, and involving both men and women;

(c) Developing sound recruitment, personnel and pay policies for staff of national and local water agencies.

Capacity-building

39. The conduct of water resources assessment on the basis of operational national hydrometric networks requires an enabling environment at all levels. The following national support action is necessary for enhanced national capacities:

(a) Review the legislative and regulatory basis of water resources assessment;

(b) Facilitate close collaboration between water sector agencies, particularly between information producers and users;

(c) Implement water management policies based upon realistic appraisals of water resource conditions and trends;

(d) Strengthen the managerial capabilities of water users groups to improve water use efficiency at the local level, including women, youth, indigenous people and local communities.

C. Protection of water resources, water quality and aquatic ecosystems

Basis for action

40. Freshwater is a unitary resource. Long-term development of global freshwater requires holistic management of the resources and a recognition of the interconnectedness of the elements that comprise freshwater and its quality. There are few regions of the world that are still exempt from problems of loss of potential sources of freshwater supply and of degraded water quality and the pollution of surface and groundwater sources. Major problems affecting the water quality of rivers and lakes arise, in variable order of importance according to different situations, from inadequately treated domestic sewage, inadequate controls on the discharges of industrial waste waters, the loss and destruction of catchment areas, siting of industrial plants, deforestation, uncontrolled shifting cultivation and poor agricultural practices, giving rise to the leaching of nutrients and pesticides. Aquatic ecosystems are disturbed and the living freshwater resources are threatened. Under certain circumstances, aquatic ecosystems are also affected by agricultural water resource development projects such as dams, river diversions, water installations and irrigation schemes. Erosion, sedimentation, deforestation and desertification have led to increased land degradation, and the creation of reservoirs has, in some cases, resulted in adverse effects on ecosystems. Many of these problems have arisen from a development model that is environmentally destructive and from a lack of public awareness and education about surface and groundwater resource protection. Ecological and human health effects are the measurable consequences, although the means to monitor them are inadequate or non-existent in many countries. There is a widespread lack of perception of the linkages between the development, management, use and treatment of water resources and aquatic ecosystems. A preventive approach, where appropriate, is crucial to avoid costly subsequent measures to rehabilitate, treat and develop new water supplies.

Objectives

41. The complex interconnected nature of freshwater systems demands that freshwater management be holistic, taking a catchment management approach, and be based on a balanced consideration of the needs of people and the environment. Already, the Mar del Plata Action Plan recognized the intrinsic linkage between water resource development projects and their important repercussions of a physical, chemical, biological, health and socio-economic nature. The overall environmental health objective was set:

> "to evaluate the consequences which the various users of water have on the environment, to support measures aimed at controlling water-related diseases, and to protect ecosystems".

41 (bis). The extent and severity of contamination of unsaturated zones and aquifers have long been underestimated owing to the relative inaccessibility of aquifers and the lack of reliable information on aquifer systems. The protection of groundwater is therefore an essential element of water resource management.

42. Three objectives will have to be pursued concurrently to integrate water quality aspects into water resource management:

(a) Maintenance of ecosystem integrity. A management principle to preserve aquatic ecosystems, including the living resources, and to protect them effectively from any form of degradation on a drainage basin basis;

(b) Public health protection. A task requiring not only the provision of safe drinking water but also the control of disease vectors in the aquatic environment;

(c) Human resources development. A key to capacity-building and a prerequisite for implementing water quality management.

43. All States, according to their capacity and available resources, through bilateral or multilateral cooperation, including through the United Nations and other relevant organizations, as appropriate, could set the following targets:

(a) Have identified those surface and groundwater resources that could be developed for use on a sustainable basis and other major water dependent resources that can be developed and, simultaneously, have initiated programmes for the protection, conservation and rational use of these resources on a sustainable basis;

(b) Have identified all potential sources of water supply and prepared outlines for their protection, conservation and rational use;

(c) Have initiated effective water pollution prevention and control programmes, based on an appropriate mixture of pollution reduction-at-source

strategies, environmental impact assessments, enforceable standards for major point-source discharges and high-risk non-point sources, commensurate with their socio-economic development;

(d) Participate, as far as appropriate, in international water quality monitoring and management programmes such as the Global Water Quality Monitoring Programme GEMS/WATER, the UNEP Environmentally Sound Management of Inland Waters, the FAO regional inland fishery bodies, and the RAMSAR Convention on Wetlands of International Importance especially as Waterfowl Habitat;

(e) Have reduced the prevalence of water-associated diseases, starting with the eradication of dracunculiasis (Guinea worm) and onchocerciasis (river blindness) by the year 2000;

(f) Have established, according to capacities and needs, biological, health, physical and chemical quality criteria for all water bodies (surface and groundwater), with a view to an ongoing improvement of water quality;

(g) Have adopted an integrated approach to environmentally sustainable management of water resources, including the protection of aquatic ecosystems and freshwater living resources;

(h) Have put in place strategies for the environmentally sound management of freshwaters and related coastal ecosystems, including the consideration of fisheries, aquaculture, animal grazing, agricultural activities and biodiversity.

Activities

44. All States, according to their capacity and available resources, and through bilateral or multilateral cooperation, including through United Nations and other relevant organizations, as appropriate, could implement the following activities:

(a) Water resources protection and conservation

(i) Establishment and strengthening of technical and institutional capacities to identify and protect potential sources of water supply within all sectors of society;

(ii) Identification of potential sources of water supply and preparation of national profiles;

(iii) Preparation of national plans for water resources protection and conservation;

(iv) Rehabilitation of important but degraded catchment areas, particularly on small islands;

(v) Strengthening of administrative and legislative measures to prevent encroachment into existing and potentially usable catchment areas;

(b) Water pollution prevention and control

(i) Application of the polluter pays principle, where appropriate, to all kinds of sources, including on-site and off-site sanitation;

(ii) Promotion of the construction of treatment facilities for domestic sewage, industrial effluents, and the development of appropriate technologies, taking into account sound traditional and indigenous practices;

(iii) Establishment of standards for the discharge of effluents and for the receiving waters;

(iv) Introduction of the precautionary approach in water quality management, where appropriate, with a focus on pollution minimization and prevention through use of new technologies, product and process change, pollution reduction at source, effluent reuse, recycling and recovery, treatment and environmentally safe disposal;

(v) Mandatory environmental impact assessment on all major water resource development projects potentially impairing water quality and aquatic ecosystems, combined with the delineation of appropriate remedial measures and a strengthened control of new industrial installations, solid waste landfills and infrastructure development projects;

(vi) Use of risk assessment and risk management in reaching decisions in this area and ensuring compliance with those decisions;

(vii) Identification and application of best environmental practices at reasonable cost to avoid diffuse pollution, i.e., through a limited, rational and planned use of nitrogenous fertilizers and other agrochemicals (pesticides, herbicides) in agricultural practices;

(viii) Encouragement and promotion of the use of adequately treated and purified waste waters in agriculture, aquaculture, industry and other sectors;

(c) Development and application of clean technology

(i) Control of industrial waste discharges, including low-waste production technologies and water recirculation, in an integrated way and by applying precautionary measures derived from a broad-based life-cycle analysis;

(ii) Treatment of municipal waste water for safe reuse in agriculture and aquaculture;

(iii) Development of biotechnology, including for waste treatment, production of biofertilizers and other activities;

(iv) Development of appropriate methods for water pollution control, taking into account sound traditional and indigenous practices;

(d) Groundwater protection

(i) Developing agricultural practices that do not degrade groundwaters;

(ii) Application of the necessary measures to mitigate saline intrusion into aquifers of small islands and coastal plains as a consequence of sealevel rise or of overexploitation of coastal aquifers;

(iii) Prevention of aquifer pollution through the regulation of toxic substances that permeate the ground and the establishment of protection zones in groundwater recharge and abstraction areas;

(iv) Design and management of landfills based upon sound hydrogeological information and impact assessment, using best practicable and best available technology;

(v) Promotion of measures to improve the safety and integrity of wells and wellhead areas to reduce intrusion of biological pathogens and hazardous chemicals into aquifers at well sites;

(vi) Water quality monitoring, as needed, of surface and groundwaters potentially affected by sites storing toxic and hazardous materials;

(e) Protection of aquatic ecosystems

(i) Rehabilitation of polluted and degraded water bodies to restore aquatic habitats and ecosystems;

(ii) Rehabilitation programmes for agricultural lands and for other users, taking into account equivalent action for the protection and use of groundwater resources, important for agricultural productivity and for the biodiversity of the tropics;

(iii) Conservation and protection of wetlands owing to their ecological and habitat importance for many species, and taking into account social and economic factors;

(iv) Control of noxious aquatic species that may destroy some other water species;

(f) Protection of freshwater living resources

(i) Control and monitoring of water quality to allow for the sustainable development of inland fisheries;

(ii) Protection of ecosystems from pollution and degradation for the development of freshwater aquaculture projects;

(g) Monitoring and surveillance of water resources and waters receiving wastes

(i) Establishment of networks for the monitoring and continuous surveillance of waters receiving wastes and of point and diffuse sources of pollution;

(ii) Promotion and extension of the application of geographical information systems environmental impact assessments;

(iii) Surveillance of pollution sources to improve the compliance with standards and regulations and to regulate the issue of discharge permits;

(iv) Monitoring of the utilization of chemicals in agriculture that may have an adverse environmental effect;

(v) Rational land use to prevent land degradation, erosion and siltation of lakes and other water bodies;

(h) Development of national and international legal instruments for water quality protection

Protection of the quality of water resources may require the development of national or international legal instruments, as appropriate, particularly for:

(i) Monitoring and control of pollution and its effects in national and transboundary waters;

(ii) Control of long-range atmospheric transport of pollutants;

(iii) Control of accidental and/or deliberate spills in national and/or transboundary water bodies;

(iv) Environmental impact assessment.

Means of implementation

Financing and cost evaluation

45. [Funds for pollution control have to be generated ultimately within each river basin and/or country through cost recovery and economic or fiscal instruments. The "polluter pays principle" has to be adopted in conformity with the notion of water as a social and an economic good. Total costs, including those financed nationally, are estimated at about US$ 1.0 billion annually for the period 1993 to 2000. Of this amount, about US$ 330 million would be needed annually from international sources.

46. The assessment of global environmental issues also includes water quality and aquatic ecosystems monitoring and assessment. River monitoring for global flux estimates is covered under programme area B already, and the necessary funds indicated there. About US$ 10 million annually would be needed in addition to this to strengthen international institutions. The total financing requirement for this programme area amounts to US$ 340 million annually.]

Scientific and technological means

47. States should undertake cooperative research projects to develop solutions to technical problems that are appropriate for the conditions in each watershed or country. States should consider strenghtening and developing national research centres linked through networks, supported by regional water research institutes. The North-South twinning of research centres and field studies by international water research institutions should be actively promoted. It is important that a minimum percentage of funds for water resource development projects is allocated to research and development, particularly in externally funded projects.

48. Monitoring and assessment of complex aquatic systems often require multidisciplinary studies involving several institutions and scientists in a joint programme. International water quality programmes, such as GEMS/WATER, should be oriented towards the water quality of developing countries. User-friendly software, GIS and GRID methods should be developed for the handling, analysis and interpretation of monitoring data and for the preparation of management strategies.

Human resource development

49. Innovative approaches should be adopted for professional and managerial staff training in order to cope with changing needs and challenges. Flexibility and adaptability to emerging water pollution issues should be developed. Training activities should be undertaken periodically at all levels within the organizations responsible for water quality management, and innovative teaching techniques adopted for specific aspects of water quality monitoring and control, including development of training skills, in-service training, problem-solving workshops and refresher training courses.

50. Suitable approaches include strengthening and improving the human resource capabilities of local governments in managing water protection, treatment and use, particularly in urban areas, and the establishment of national and regional technical and engineering courses on water quality protection and control subjects at existing schools, and education/training courses for laboratory and field technicians, women and other water user groups for water resources protection and conservation.

Capacity-building

51. The effective protection of water resources and ecosystems from pollution requires considerable upgrading of most countries' present capacities. Water quality management programmes require a certain minimum infrastructure and staff to identify and implement technical solutions and to enforce regulatory action. One of the key problems today and for the future is the sustained operation and maintenance of these facilities. In order not to allow resources gained from previous investments to deteriorate further, immediate action is required in a number of areas.

D. Drinking water supply and sanitation

Basis for action

52. Safe water supplies and environmental sanitation are vital for protecting the environment, improving health and alleviating poverty. Safe water is also crucial to many traditional and cultural activities. An estimated 80 per cent of all diseases and over one third of deaths in developing countries are caused by the consumption of contaminated water, and on average as much as one tenth of each person's productive time is sacrificed to water-related diseases. Concerted efforts during the 1980s brought water and sanitation services to hundreds of millions of the world's poorest people. The most outstanding of these efforts is the launching in 1981 of the United Nations International Drinking Water Supply and Sanitation Decade, which resulted from the Mar del Plata Action Plan adopted by the United Nations Water Conference in 1977. The commonly agreed premise was that "all peoples, whatever their stage of development and their social and economic conditions, have the right to have access to drinking water in quantities and of a quality equal to their basic needs". The target of the Decade was to provide safe drinking water and sanitation to underserved urban and rural areas by 1990. But even the unprecedented progress achieved during the Decade was not enough. One in three people in the developing world still lacks these two most basic requirements for health and dignity. It is also recognized that human excreta and sewage are important causes of the deterioration of water quality in developing countries, and the introduction of available technologies, including appropriate technologies, and the construction of sewage treatment facilities could bring significant improvement.

Objectives

53. The New Delhi Statement formalized the need to provide, on a sustainable basis, access to safe water in sufficient quantities and proper sanitation for all, emphasizing the "some for all rather than more for some" approach. Four guiding principles provide for the programme objectives:

(a) Protection of the environment and safeguarding of health through the integrated management of water resources and liquid and solid wastes;

(b) Institutional reforms promoting an integrated approach and including changes in procedures, attitudes and behaviour, and the full participation of women at all levels in sector institutions;

(c) Community management of services, backed by measures to strengthen local institutions in implementing and sustaining water and sanitation programmes;

(d) Sound financial practices, achieved through better management of existing assets, and widespread use of appropriate technologies.

54. Past experience has shown that specific targets should be set by each individual country. At the World Summit for Children, in September 1990, heads of State or Government called for both universal access to water supply and sanitation and the eradication of guinea worm disease by 1995. Even for the more realistic target of achieving full coverage in water supply by 2025, it is estimated that annual investments must reach double the current levels. One realistic strategy to meet present and future needs, therefore, is to develop lower cost but adequate services that can be implemented and sustained at the community level.

Activities

55. All States, according to their capacity and available resources, and through bilateral or multilateral cooperation, including through the United Nations and other relevant organizations, as appropriate, could implement the following activities:

(a) Environment and health

(i) Establishment of protected areas for sources of drinking water supply;

(ii) Sanitary disposal of excreta and sewage, using appropriate systems to treat waste waters in urban and rural areas;

(iii) Expansion of urban and rural water supply and, in addition to the reticulated water supply system, develop and expand rainwater catchment systems, particularly on small islands;

(iv) Building and expansion, where appropriate, of sewage treatment facilities and drainage systems;

(v) Treatment and safe reuse of domestic and industrial waste waters in urban and rural areas;

(vi) Control of water-associated diseases;

(b) People and institutions

(i) Strengthening the functioning of Governments in water resources management and, at the same time, giving full recognition to the role of local authorities;

(ii) Encouraging water development and management based on a participatory approach, involving users, planners and policy makers at all levels;

(iii) Applying the principle that decisions are taken at the lowest appropriate level, with public consultation and involvement of users in the planning and implementation of water projects;

(iv) Human resource development at all levels, including special programmes for women;

(v) Broad-based education programmes, with particular emphasis on hygiene, local management and risk reduction;

(vi) [International support mechanisms for programme funding, implementation, and follow-up];

(c) National and community management

(i) Support and assist communities in managing their own systems on a sustainable basis;

(ii) Encouragement of the local population, especially women, youth, indigenous people and local communities in water management;

(iii) Linkages between national water plans and community management of local waters;

(iv) Integration of community management of water in the context of overall planning;

(v) Promotion of primary health and environmental care at the local level, including training for local communities in appropriate water management techniques and primary health care;

(vi) Assisting service agencies to be more cost-effective and responsive to consumer needs;

(vii) More attention to be given to underserved rural and low-income peri-urban areas;

(viii) Rehabilitation of defective systems, reduction of wastage and safe reuse of water and waste water [through additional international financing];

(ix) Programmes for rational water use and ensured operation and maintenance;

(x) Research and development of appropriate technical solutions;

(xi) [International efforts of solidarity by the developed countries with the developing countries in granting new and additional financial resources in accordance with General Assembly resolution 44/228 in order to install treatment plants for urban waste waters];

(d) Awareness creation and public information/participation

(i) Strengthening of sector monitoring and information management at subnational and national levels;

(ii) Annual processing, analysis and publishing of monitoring results at national and local levels as a sector management and advocacy/awareness creation tool;

(iii) Use of limited sector indicators at regional and global levels to promote the sector and raise funds;

(iv) Improve sector coordination, planning and implementation, with assistance of improved monitoring and information management, to increase the sector's absorptive capacity, particularly in community-based self-help projects.

Means of implementation

Financing and cost evaluation

56. [Accelerated development is necessary to reach the desired coverage of water supply and basic sanitation services by the year 2000. The rate of investment for the years until 2000 has, at least, to be doubled to a total of US$ 20 billion annually to achieve complete service coverage. The external component should be maintained at no less than one third of this, i.e. at about US$ 6.7 billion annually. The improved operation, maintenance and management of systems and the full utilization of the investments made requires the allocation of external support in the order of US$ 0.7 billion. The total external funding needs until the year 2000 are, therefore, US$ 7.4 billion annually.]

Scientific and technological means

57. To ensure the feasibility, acceptability and sustainability of planned water supply services, adopted technologies should be responsive to the needs and constraints imposed by the conditions of the community concerned. Thus, design criteria involve technical, health, social, economic, provincial, institutional and environmental aspects that determine the characteristics, magnitude and cost of the planned system. Relevant international support programmes should address the developing countries concerning, inter alia:

(a) Pursuit of low-cost scientific and technological means, as far as practicable;

(b) Utilization of traditional and indigenous practices, as far as practicable, to maximize and sustain local involvement;

(c) Assistance to country-level technical/scientific institutes to facilitate curricula development to support fields critical to the water and sanitation sector.

Human resource development

58. To effectively plan and manage water supply and sanitation at the national, provincial, district and community level, and to utilize funds most effectively, trained professional and technical staff must be developed within each country in sufficient numbers. To do this, countries must establish manpower development plans, taking into consideration present requirements and planned developments. Subsequently, the development and performance of country-level training institutions should be enhanced so that they can play a pivotal role in capacity-building. It is also important that countries provide adequate training for women in the sustainable maintenance of equipment, water resource management and environmental sanitation.

Capacity-building

59. The implementation of water supply and sanitation programmes is a national responsibility. To varying degrees, responsibility for the implementation of projects and the operating of systems should be delegated to all administrative levels right down to the community and individual served. This also means that national authorities, together with the agencies and bodies of the United Nations system and other external support agencies in providing support to national programmes, should develop mechanisms and procedures to collaborate at all levels. This is particularly important if full advantage is to be taken of community-based approaches and self-reliance as tools to sustainability. This entails a high degree of community participation, involving women, in the conception, planning, decision-making, implementation and evaluation of projects for domestic water supply and sanitation.

60. Overall national capacity-building at all administrative levels, including institutional development, coordination, human resources, community participation, health and hygiene education, literacy etc., have to be developed as fundamental to any efforts to improve health and socio-economic development through water supply and sanitation and their impact on the human environment. Capacity-building should therefore be one of the underlying keys in implementation strategies. Institutional capacity-building should be considered as equally important as sector supplies and equipment, so that funds can be directed to both aspects. This can be undertaken at the planning or programme/project formulation stage with clear definition of objectives and targets in this regard. In this respect, technical cooperation among developing countries is crucial, owing to available wealth of information and experience, and to avoid reinventing the wheel. This has proved cost-effective in many country projects already.

E. Water and sustainable urban development

Basis for action

61. Early in the next century, more than half of the world's population will be living in urban areas. By 2025, that proportion will have risen to 60 per cent, some 5 billion people. Rapid urban population growth and industrialization are putting severe strains on the water resources and environmental protection capabilities of many cities. Special attention needs to be given to the growing effects of urbanization on water demands and usage, and on the critical role played by local and municipal authorities in managing the supply, use and overall treatment of water, particularly in developing countries for which special support is needed. Scarcity of freshwater resources and the escalating costs of developing new resources have a considerable impact on national industrial, agricultural and human settlement development and economic growth. Better management of urban water resources, including the elimination of unsustainable consumption patterns, can make a substantial contribution to the alleviation of poverty and improvement of the health and quality of life of the urban and rural poor. A high proportion of large urban agglomerations are located around estuaries and in coastal zones, leading to pollution from municipal and industrial discharges combined with overexploitation of available water resources and threatening the marine environment and the supply of freshwater resources.

Objectives

62. The development objective of this programme is to support local and central governments' efforts and capacities to sustain national development and productivity through environmentally sound management of water resources for urban use. Supporting this objective is the identification and implementation of strategies and actions to ensure the continued supply of affordable water for present and future needs, and to reverse current trends of resource degradation and depletion.

63. [All States, according to their capacity and available resources, and through bilateral or multilateral cooperation, including through the United Nations and other relevant organizations, as appropriate, could set the following targets:

(a) By the year 2000, ensure that all urban residents have access to at least 40 litres per capita per day of safe water and that 75 per cent of the urban population are provided with on-site or community facilities for sanitation;

(b) By the year 2000, have established and applied quantititative and qualitative discharge standards for municipal and industrial effluents;

(c) By the year 2000, have 75 per cent of solid waste generated in urban areas collected and recycled or disposed of in an environmentally safe way.]

Activities

64. All States, according to their capacity and available resources, and through bilateral or multilateral cooperation, including through the United Nations and other relevant organizations, as appropriate, could implement the following activities:

(a) Protection of water resources from depletion, pollution and degradation

(i) Introduction of sanitary waste disposal facilities based on environmentally sound low-cost and upgradable technologies;

(ii) Implementation of urban storm water runoff and drainage programmes;

(iii) Promotion of recycling and reuse of waste water and solid wastes;

(iv) Control of industrial pollution sources to protect water resources;

(v) Protection of watersheds from depletion and degradation of their forest cover and from harmful upstream activities;

(vi) Promotion of research into the contribution of forests to sustainable water resources development;

(vii) Encouragement of best management practices for the use of agrochemicals with a view to minimizing their impact on water resources;

(b) Efficient and equitable allocation of water resources

(i) Reconciliation of city development planning with the availability and sustainability of water resources;

(ii) Satisfaction of the basic water needs of the urban population;

(iii) Introduction of water tariffs, by taking into account the circumstances in each country and where affordable, which reflect the marginal and opportunity cost of water, especially for productive activities;

(c) Institutional/legal/management reforms

(i) Adoption of a city-wide approach to the management of water resources;

(ii) Promotion at the national and local level of the elaboration of land use plans that give due consideration to water resources development;

(iii) Utilization of the skills and potential of non-governmental organizations and the private sector and local people, taking into account the public and strategic interests in water resources;

(d) Promotion of public participation

(i) Initiation of public awareness campaigns to encourage the public towards rational water utilization;

(ii) Sensitization of the public for the protection of water quality within the urban environment;

(iii) Promotion of public participation for the collection, recycling and elimination of wastes;

(e) Support to local capacity-building

(i) Development of legislation and policies to promote investments in urban water and waste management, reflecting the major contribution of cities to national economic development;

(ii) Provision of seed money and technical support to the local handling of materials supply and services;

(iii) Encouragement, to the extent possible, of autonomy and financial viability of city water, solid waste and sewerage utilities;

(iv) Creation and maintenance of a cadre of professionals and semi-professionals, for water, waste water and solid waste management;

(f) Provision of enhanced access to sanitary services

(i) Implement water, sanitation and waste management programmes focused on the urban poor;

(ii) Make low-cost water supply and sanitation technology choices available;

(iii) Base choice of technology and service levels on user preferences and willingness to pay;

(iv) Mobilize and facilitate the active involvement of women in water management teams;

(v) Encourage and equip local water association and water committees to manage community water supply systems and communal latrines, with technical back-up available when required;

(vi) Consider the merits and practicality of rehabilitating existing malfunctioning systems and correcting operation and maintenance inadequacies.

Means of implementation

Financing and cost evaluation

65. [Total costs incurring for the installation of sewage collection and treatment facilities amount to about US$ 9 billion annually, including about US$ 1.8 billion in external financing. The needs for urban drainage programmes are also about US$ 9 billion annually, including about US$ 2.3 billion in international funding. Operation and maintenance and related capacity-building measures require about US$ 1.8 billion annually, including about US$ 0.4 billion in international financial support. The total external financing requirements amount to about US$ 4.5 billion annually.]

Scientific and technological means

66. The 1980s saw considerable progress in the development and application of low-cost water supply and sanitation technologies. The programme envisages continuation of this work, with particular emphasis on development of appropriate sanitation and waste disposal technologies for low-income high-density urban settlements. There should also be international information exchange, to ensure a widespread recognition among sector professionals of the availability and benefits of appropriate low-cost technologies. The public awareness campaigns will also include components to overcome user resistance to "second class" services, emphasizing the benefits of reliability and sustainability.

Human resource development

67. Implicit in virtually all the elements of this programme is the need for progressive enhancement of the training and career development of personnel at all levels in sector institutions. Specific programme activities will involve the training and retention of staff with skills in community involvement, low-cost technology, financial management, and integrated planning of urban water resources management. Special provision should be made for mobilizing and facilitating the active participation of women, youth, indigenous people and local communities in water management teams, and for supporting the development of water associations and water committees, with appropriate training of treasurers, secretaries, caretakers etc. Special education and training programmes for women should be launched with regard to the protection of water resources and water quality within urban areas.

Capacity-building

68. In combination with human resource development, strengthening of institutional, legislative and management structures are key elements of the programme. A prerequisite for progress in enhancing access to water and sanitation services is the establishment of an institutional framework that ensures that the real needs and potential contributions of currently unserved populations are reflected in urban development planning. The multisectoral approach, which is a vital part of urban water resources management, requires institutional linkages at national and city levels, and the programme includes proposals for establishing intersectoral planning groups. Proposals for greater pollution control and prevention depend for their success on the right combination of economic and regulatory mechanisms, backed by adequate monitoring and surveillance and supported by enhanced capacity to address environmental issues on the part of local governments.

69. Establishment of appropriate design standards, water quality objectives and discharge consents is therefore among the proposed activities. The programme also includes support for strengthening the capability of water and sewerage agencies, and for developing their autonomy and financial viability. Operation and maintenance of existing water and sanitation facilities has been recognized as a serious shortcoming in many countries. Technical and financial support is needed to help countries to correct present inadequacies and build up the capacity to operate and maintain rehabilitated and new systems.

F. Water for sustainable food production and rural development

Basis for action

70. Sustainability of food production increasingly depends on sound and efficient water use and conservation practices consisting primarily of irrigation development and management, including water management in rainfed areas, livestock water supply, inland fisheries and agro-forestry. Achieving food security is a high priority in many countries, and agriculture must not only provide food for rising populations, but also save water for other uses. The challenge is to develop and apply water-saving technology and management methods, and, through capacity-building, enable communities to introduce institutions and incentives for the rural population to adopt new approaches, for both rainfed and irrigated agriculture. The rural population must also have better access to a potable water supply and to sanitation services. It is an immense task, but not an impossible one, provided appropriate policies and programmes are adopted at all levels - local, national and international. While significant expansion of the area under rainfed agriculture has been achieved during the past decade, the productivity response and sustainability of irrigation systems have been constrained by problems of water-logging and salinization. Financial and market constraints are also a common problem. Soil erosion, mismanagement and overexploitation of natural resources and acute competition for water, have all influenced the extent of poverty, hunger

and famine in the developing countries. Soil erosion caused by overgrazing of livestock is also often responsible for the siltation of lakes. The development of irrigation schemes is most often not supported by environmental impact assessments identifying hydrological consequences within watersheds and owing to interbasin transfers, nor by the assessment of social impacts on peoples in river valleys.

71. The non-availability of water supplies of suitable quality is a significant limiting factor to livestock production in many countries and improper disposal of animal wastes can in certain circumstances result in pollution of water supplies for both humans and animals. The drinking water requirements of livestock vary according to species and environment in which they are kept. It is estimated that the current global livestock drinking water requirement is about 60 billion litres a day and, based on livestock population growth estimates, this daily requirement is predicted to increase by 0.4 billion litres per annum in the foreseeable future.

72. Freshwater fisheries in lakes and streams are an important source of food and protein. Fisheries of inland waters should be managed to maximize the yield of aquatic food organisms in an environmentally sound manner. This requires the conservation of water quality and quantity, as well as the functional morphology of the aquatic environment. On the other hand, fishing and aquaculture themselves may damage the aquatic ecosystem and hence their development should conform to guidelines for impact limitation. Present levels of production from inland fisheries, both from fresh and brackish water, are about 7 million tons per year and could increase to 16 million tons per year by the year 2000; however, any increase in environmental stress could jeopardize this rise.

Objectives

72 (bis). The key strategic principles for holistic and integrated environmentally sound management of water resources in the rural context are:

(a) Water should be regarded as a finite resource that has an economic value with significant social and economic implications, taking into consideration the importance of meeting basic needs;

(b) Local communities must participate in all phases of water management, ensuring the full involvement of women in view of their crucial role in the practical day-to-day supply, management and use of water;

(c) Water resource management must be developed within a comprehensive set of policies for (i) human health; (ii) food production, preservation and distribution; (iii) disaster mitigation plans; (iv) environmental protection and conservation of the natural resource base;

(d) The need to recognize and actively support the role of rural populations, with particular emphasis on women.

73. An International Action Programme on Water and Sustainable Agricultural Development (IAP-WASAD) has been initiated by FAO in cooperation with other international organizations. The main objective of the Action Programme is to assist developing countries in planning, developing and managing water resources on an integrated basis to meet the present and future needs for agricultural production, taking into account environmental considerations.

74. The Action Programme has developed a framework for sustainable water use in the agricultural sector and identified priority areas for action at national, regional and global levels. Quantitative targets for new irrigation development, improvement of existing irrigation schemes and reclamation of waterlogged and salinized lands through drainage for 130 developing countries are estimated on the basis of food requirements, agro-climatic zones and availability of water and land.

75. The FAO global projections for irrigation, drainage and small-scale water programmes by the year 2000 for 130 developing countries are:
(a) 15.2 million hectares of new irrigation development;
(b) 12 million hectares of improvement/modernization of existing schemes;
(c) 7 million hectares installed with drainage and water control facilities;
and (d) 10 million hectares of small-scale water programmes and conservation.

76. The development of new irrigation areas at the above level may give rise to environmental concerns as this may imply the destruction of wetlands, water pollution, increased sedimentation and a reduction in biodiversity. Therefore, new irrigation schemes should be accompanied by an environmental impact assessment in case significant negative environmental impacts are expected and also depending upon the scale of the scheme. When considering proposals for new irrigation schemes, consideration should also be given to a more rational exploitation, and increasing the efficiency or productivity, of any existing schemes capable of serving the same localities. Technologies for new irrigation schemes should be thoroughly evaluated, including their potential conflicts with other land uses. The active involvement of water users groups is a supporting objective.

76 (bis). It should be ensured that rural communities of all countries, according to their capacities and available resources and taking advantage of international cooperation as appropriate, will have access to safe water in sufficient quantities and adequate sanitation to meet their health needs and maintain the essential qualities of their local environments.

77. The objectives with regard to water management for inland fisheries and aquaculture include conservation of water quality and quantity requirements for optimum production and prevention of water pollution by aquacultural activities. The Action Programme seeks to assist member countries in managing the fisheries of inland waters through the promotion of sustainable management of capture fisheries as well as the development of environmentally sound approaches to intensification of aquaculture.

78. The objectives with regard to water management for livestock supply are twofold: provision of adequate amounts and safeguarding of drinking-water quality in accordance with the specific needs of different animal species. This entails maximum salinity tolerance levels and the absence of pathogenic organisms. No global targets can be set owing to large regional and intra-country variations.

Activities

79. All States, according to their capacity and available resources, and through bilateral or multilateral cooperation, including through the United Nations and other relevant organizations, as appropriate, could implement the following activities:

(a) Water supply and sanitation for the unserved rural poor

(i) Establish national policies and budget priorities with regard to increasing service coverage;

(ii) Promote appropriate technologies;

(iii) Introduce suitable cost-recovery mechanisms, taking into account efficiency and equity through demand management mechanisms;

(iv) Promote community ownership and rights to water supply and sanitation facilities;

(v) Establish monitoring and evaluation systems;

(vi) Strengthen the rural water supply and sanitation sector with emphasis on institutional development, efficient management and an appropriate framework for financing of the services;

(vii) Increase hygiene education and eliminate disease transmission foci;

(viii) Adopt appropriate technologies for water treatment;

(ix) Adopt wide-scale environmental management measures to control disease vectors;

(b) Water use efficiency

(i) Increase of efficiency and productivity in agricultural water use for better utilization of limited water resources;

(ii) Strengthening of water and soil management research under irrigation and rainfed conditions;

(iii) Monitoring and evaluation of irrigation project performance to ensure, inter alia, the optimal utilization and proper maintenance of the project;

(iv) Support to water users groups with a view to improving management performance at the local level;

(v) Supporting the appropriate use of relatively brackish water for irrigation;

(c) Waterlogging, salinity control and drainage

(i) Introduction of surface drainage in rainfed agriculture to prevent temporary waterlogging and flooding of lowlands;

(ii) Introduction of artificial drainage in irrigated and rainfed agriculture;

(iii) Encouragement of conjunctive use of surface and groundwaters, including monitoring and water balance studies;

(iv) Practising of drainage in irrigated areas of arid and semi-arid regions;

(d) Water quality management

(i) Establishment and operation of cost-effective water quality monitoring systems for agricultural water uses;

(ii) Prevention of adverse effects of agricultural activities on water quality for other social and economic activities and on wetlands, inter alia, through optimal use of on-farm inputs and the minimization of the use of external inputs in agricultural activities;

(iii) Establishment of biological, physical and chemical water quality criteria for agricultural water users and for marine and riverine ecosystems;

(iv) Prevention of soil run-off and sedimentation;

(v) Proper disposal of sewage from human settlements and of manure produced by intensive livestock breeding;

(vi) Minimize adverse effects from agricultural chemicals by use of integrated pest management;

(vii) Education of communities about the pollution impacts of the use of fertilizers and chemicals on water quality, food safety and human health risks;

(e) Water resources development programmes

(i) Development of small-scale irrigation, water supply for humans and livestock and for water and soil conservation;

(ii) Formulation of large-scale and long-term irrigation development programmes, taking into account their effects on the local level, the economy and the environment;

(iii) Promotion of local initiatives for the integrated development and management of water resources;

(iv) Provision of adequate technical advice and support and enhancement of institutional collaboration at the local community level;

(v) Promotion of a farming approach for land and water management that takes account of the level of education, the capacity to mobilize local communities, and the ecosystem requirements of arid and semi-arid regions;

(vi) Planning and development of multi-purpose hydro-electric power schemes, making sure that environmental concerns are duly taken into account;

(f) Scarce water resources management

(i) Development of long-term strategies and practical implementation programmes for agricultural water use under scarcity conditions with competing demands for water;

(ii) Recognition of water as a social, economic and strategic good in irrigation planning and management;

(iii) Formulation of specialized programmes focused on drought preparedness, with emphasis on food scarcity and environmental safeguards;

(iv) Promotion and enhancement of waste water reuse in agriculture;

(g) Water supply for livestock

(i) Improve quality of water available to livestock, taking into account their tolerance limits;

(ii) Increase the quantity of water sources available to livestock, and in particular those in extensive grazing systems, in order to both reduce the distance needed to travel for water and to prevent overgrazing around water sources;

(iii) Prevent contamination of water sources with animal excrement in order to prevent the spread of diseases and in particular zoonosis;

(iv) Encourage multiple use of water supplies through promotion of integrated agro-livestock-fishery systems;

(v) Encourage water spreading schemes to increase water retention of extensive grasslands to stimulate forage production and prevent run-off;

(h) Inland fisheries

(i) Develop the sustainable management of fisheries as part of national water resources planning;

(ii) Study specific aspects of the hydro-biology and environmental requirements of key inland fish species in relation to varying water regimes;

(iii) Prevent, mitigate or rehabilitate aquatic environments subjected to modification by other users for the sustainable use and conservation of biological diversity of living aquatic resources;

(iv) Develop and disseminate environmentally sound water resources development and management methodologies for the intensification of fish yield from inland waters;

(v) Establish and maintain adequate systems for the collection and interpretation of data on water quality, quantity and channel morphology related to management and the state of living aquatic resources, including fisheries;

(i) Aquaculture development

(i) Develop environmentally sound aquaculture technologies that are compatible with local, regional and national water resources management plans and taking into consideration social factors;

(ii) Introduce appropriate aquaculture techniques and related water development and management practices in countries not yet experienced in aquaculture;

(iii) Assess environmental impacts of aquaculture with specific reference to commercialized culture units and potential water pollution from processing centres;

(iv) Evaluate economic feasibility of aquaculture in relation to alternative use of water, taking into consideration the use of marginal quality water and investment and operational requirements.

Means of implementation

Financing and cost evaluation

80. [During the period 1993 to 2000, total annual costs for investments and technical support in this programme area are estimated at about US$ 13.2 billion, of which about US$ 4.5 billion would have to come from international sources. This includes also about US$ 10 million annually to strengthen international, global and regional organizations.]

Scientific and technological means

81. There is an urgent need for countries to monitor water resources and water quality, water and land use and crop production; compile inventories of type and extent of agricultural water development and their present and future contributions to sustainable agricultural development; evaluate the potential for fisheries and aquaculture development; and improve the availability and dissemination of data to planners, technicians, farmers and fishermen. Priority requirements for research are as follows:

(a) Identify critical areas for water-related adaptive research;

(b) Strengthen the adaptive research capacities of institutions in developing countries;

(c) Enhance translation of water-related farming and fishing systems research results into practical and accessible technologies and provide the support needed for their quick adoption at the field level.

82. Transfer of technology, both horizontal and vertical, needs to be strengthened. Mechanisms to provide credit, input supplies, markets, appropriate pricing and transportation must be developed jointly by countries and external support agencies. Integrated rural water supply infrastructure should be expanded for multiple uses and assist in developing the rural economy including facilities for water-related education and training and support services for agriculture.

Human resource development

83. Education and training of human resources should be actively pursued at the national level through: (a) assessment of current and long-term human resources management and training needs; (b) establishment of a national policy for human resources development; and (c) initiation and implementation of training programmes for staff at all levels as well as for farmers. The necessary actions are as follows:

(a) Assess training needs for agricultural water management;

(b) Increase formal and informal training activities;

(c) Develop practical training courses for improving the ability of extension services to disseminate technologies and strengthen farmers' capabilities, with special reference to small-scale producers;

(d) Train staff at all levels, including farmers, fishermen and members of local communities, with particular reference to women;

(e) Increase the opportunities for career development to enhance the capabilities of administrators and officers at all levels involved in land and water-management programmes.

Capacity-building

84. The importance of a functional and coherent institutional framework at the national level to promote water and sustainable agricultural development has been generally fully recognized at present. In addition, an adequate legal framework of rules and regulations should be in place to facilitate actions on agricultural water use, drainage, water quality management, small-scale water programmes and the functioning of water users' and fishermen's associations. Legislation specific to the needs of the agricultural water sector should be consistent with, and stem from, general legislation for the management of water resources. Actions should be pursued in the following areas:

(a) Improve agricultural-, fisheries- and rural development-related water use policies and legal frameworks for implementing such policies;

(b) Review, strengthen and restructure, if required, existing institutions in order to enhance their capacities in water-related activities, while recognizing the need to manage water resources at the lowest appropriate level;

(c) Review and strengthen, where necessary, organizational structure, functional relationships and linkages among ministries and departments within a ministry;

(d) Provide specific measures that require support for institutional strengthening, including long-term programme budgeting, staff training, incentives, mobility, equipment and coordination mechanisms;

(e) Enhance involvement of the private sector, where appropriate, in human resource development and provision of infrastructure;

(f) Transfer existing and new water use technologies by creating mechanisms for cooperation and information exchange among national and regional institutions.

G. Impacts of climate change on water resources

Basis for action

85. There is uncertainty in the prediction of climate change at the global level; the uncertainties increase greatly at the regional, national and local levels and yet it is at the national level that the most important decisions would need to be made. Higher temperatures or decreased precipitation would lead to decreased water supplies and increased water demands, and it may cause deterioration of the quality of freshwater bodies, putting strains on the already fragile balance between supply and demand in many countries. Even where precipitation might increase, there is no guarantee that it would occur at the time of year when it can be used and in addition there may be a likelihood of increased flooding. Any rise in sealevel will often cause the intrusion of salt water in estuaries, small islands and coastal aquifers and the flooding of low-lying coastal areas; this puts low-lying countries at great risk.

86. The Ministerial Declaration of the Second World Climate Conference states that "the potential impact of such climate change could pose an environmental threat of an up to now unknown magnitude; and could even threaten survival in some small island States and in low-lying coastal, arid and semi-arid areas". The Conference recognized that among the most important impacts of climate change were its effects on the hydrological cycle and water management systems and, through these, on socio-economic systems. Increase in incidence of extremes, such as floods and droughts, would cause increased frequency and severity of disasters. The Conference therefore called for a strengthening of the necessary research and monitoring programmes and the exchange of relevant data and information, these actions to be undertaken at the national, regional and international levels.

Objectives

87. The very nature of this topic calls first and foremost for more information about and greater understanding of the threat that is being faced. [Subject to the outcome of the Intergovernmental Negotiating Committee on a Framework Convention for Climate Change] this may be translated into the following objectives:

(a) To understand and quantify the threat of the impact of climate change on freshwater resources;

(b) To facilitate the implementation of effective national counter-measures, as and when the threatening impact is seen as sufficiently confirmed to justify such action;

(c) To study the potential impacts of climate change on areas prone to droughts and floods.

Activities

88. All States, according to their capacity and available resources, and through bilateral or multilateral cooperation, including through the United Nations and other relevant organizations, as appropriate, could implement the following activities:

(a) Monitor the hydrological regime, including soil moisture, groundwater balance, penetration and transpiration of water quality, and related climate factors, especially in those regions and countries most likely to suffer from the adverse effects of climate change, where the localities vulnerable to these effects should be defined;

(b) Develop and apply techniques and methodologies for assessing the potential adverse effects of climate change, through changes in temperature, precipitation and sealevel rise on freshwater resources and the flood risk;

(c) Initiate case-studies to establish whether there are linkages between climate changes and the current occurrences of droughts and floods in certain regions;

(d) Assess the resulting social, economic and environmental impacts;

(e) Develop and initiate response strategies to counter the adverse effects that are identified, including changing groundwater levels, and the mitigation of saline intrusion into aquifers;

(f) Develop agricultural activities based on brackish water use;

(g) Contribute to the research activities under way within the framework of current international programmes.

Means of implementation

Financing and cost evaluation

89. [During the years 1993 to 2000, national programmes to assess and mitigate the effects of climate change will incur costs of about US$ 100 million annually, of which about US$ 40 million would have to come from international sources. Joint international research and case-studies require an additional US$ 4 million annually.]

Scientific and technological means

90. Monitoring of climate change and its impact on freshwater bodies must be closely integrated with national and international programmes for monitoring the environment, in particular those concerned with the atmosphere, as discussed under other sections of Agenda 21, and with the hydrosphere, as discussed under programme area B above. The analysis of data for indication of climate change as a basis for developing remedial measures is a complex

task. Extensive research is necessary in this area and due account has to be taken of the work of the International Panel on Climate Change (IPCC), the International Geosphere-Biosphere Programme (IGBP) and other relevant international programmes.

91. The development and implementation of response strategies requires innovative use of technological means and engineering solutions, including the installation of flood and drought warning systems and the construction of new water-resource development projects such as dams, aqueducts, well fields, waste water treatment plants, desalination works, levees, banks and drainage channels. There is also a need for coordinated research networks such as the IGBP/START network.

Human resource development

92. The developmental work and innovation depend for their success on good academic training and staff motivation. International projects can help by enumerating alternatives, but each country needs to establish and implement the necessary policies and to develop its own expertise in the scientific and engineering challenges to be faced, plus a body of dedicated individuals who are able to interpret the complex issues concerned for those required to make policy decisions. These specialized personnel need to be trained, hired and retained in service where they can serve their countries in these tasks.

Capacity-building

93. There is a need, however, to build a capacity at the national level to develop, review and implement response strategies. Construction of major engineering works and installation of forecasting systems will require significant strengthening of the agencies responsible, whether in the public or the private sector. Most critical is the requirement for a socio-economic mechanism which can review predictions of the impact of climate change and possible response strategies and make the necessary judgements and decisions.